



SEQUENCE LISTING

I. du Pont de Nemours and Company

<120> Genes Encoding Sulfate Assimilation Proteins

<130> BB-1167-B

<140>

<141>

<150> 60/092,833

<151> 1998-07-14

<160> 14

<170> Microsoft Office 97

<210> 1

<211> 890

<212> DNA

<213> Zea mays

<400> 1

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agggctctgt gaaccagaag ggctgcgtcg tgtggatcac tggcctaagc ggttcaggga 180
aaagcacgct cgcgtgcgcy ctgagccgcy agctgcacgg cagaggccac ctacgtacg 240
tcctcgacgg cgacaacctc aggcacgggc tgaacaggga cctcagcttc ggagcagagg 300
accgcgccga gaacatccgc agagtagggg aagttagcga gctgttcgcc gacgtggcc 360
tcgtctgcat cgccagcctc atatcgccct acagaagcga ccgaagcgcy tgcgcgac 420
tgctgccccaa gcactcgttt atcgaggtgt tcctggacgt gccgcttcaa gtgtgcgaag 480
ccagggaacc caaaggcctc tacaagctcg cagcgccgcy caaaatcaaa gggttcaccg 540
gcatcgacga tccttacgaa ccgccgtcgg actgtgagat agtgatccag tgtaaagtcg 600
gcgactgccc ttgcctgaa tcgatggctg gtcacgttgt gtcgtacctt gagacgaatg 660
gtttcctcca ggactagaca tggaatgcga tcgatgcgtc tgatgtgtat atatgtagca 720
gcagccggag cggcattgcc aaggctgtgt aatctcatgg ctgtctttct ctttaagacc 780
aaaaaacaac agagatggca gtgtaaaaag gaaaaaaaaa actgcgtctg acagagtcgc 840
tgaatcaacc atgcttctga taaaaaaaaa aaaaaaaaaa aaaaaaaaaa 890

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<210> 2

<211> 224

<212> PRT

<213> Zea mays

<400> 2

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Ser Ala Ala Ala Val Ala Gly Ile Ser Ser Ser Ser Ser Ala Leu
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Val Thr Ser Thr Val Gly Lys Ser Thr Asn Ile Leu Trp His Glu Cys
  20             25             30

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```

Ala Ile Gly Gln Lys Glu Arg Gln Gly Leu Leu Asn Gln Lys Gly Cys
  35             40             45

```

```

Val Val Trp Ile Thr Gly Leu Ser Gly Ser Gly Lys Ser Thr Leu Ala
  50             55             60

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```

Cys Ala Leu Ser Arg Glu Leu His Gly Arg Gly His Leu Thr Tyr Val
  65             70             75             80

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<400> 4

Arg Pro Phe His Phe Ile Asn Gln Thr Glu Pro Leu Val Thr His Thr
1 5 10 15

Gln Gln Pro Pro Ser Pro Ala Pro Gly Pro Ala Ser Gln Gly Gln Arg
20 25 30

Gln Gly Asn Thr Leu Leu Ser Pro Thr Pro Thr Leu Ala Val Ile Leu
35 40 45

Val Asn Pro Gln Arg Ala Pro Pro Val Leu Pro Gly Leu Thr Pro Ser
50 55 60

Asp Ala Pro Leu Pro Ala Leu Val Ile His Gly Leu Thr Pro Arg Ser
65 70 75 80

Ser His Ser Ser Ala Gly Leu Ala Ser Asp Ser Gly Arg Arg Glu Gly
85 90 95

Glu Gly Arg Gly Ala Arg Thr His Cys His Arg Gly Ile Gly Arg Trp
100 105 110

Val Arg Arg Arg Arg Arg Asn Gly Ala Ala Pro Gly Glu Ala Pro His
115 120 125

Ser Pro Val Lys Glu Lys Pro Val Met Ser Asn Ile Gly Lys Ser Thr
130 135 140

Asn Ile Leu Trp His Asn Cys Leu Ile Gly Gln Ser Asp Arg Gln Lys
145 150 155 160

Leu Leu Gly Gln Lys Gly Cys Val Val Trp Ile Thr Gly Leu Ser Gly
165 170 175

Ser Gly Lys Ser Thr Leu Ala Cys Ala Leu Ser Arg Glu Leu His Cys
180 185 190

Arg Gly His Leu Thr Tyr Val Leu Asp Gly Asp Asn Leu Arg His Gly
195 200 205

Leu Asn Arg Asp Leu Ser Phe Lys Ala Glu Asp Arg Ala Glu Asn Ile
210 215 220

Arg Arg Val Gly Glu Val Ala Lys Leu Phe Ala Asp Ala Gly Val Ile
225 230 235 240

Cys Ile Ala Ser Leu Ile Ser Pro Tyr Arg Arg Asp Arg Asp Ala Cys
245 250 255

Arg Ala Leu Leu Pro His Ser Asn Phe Ile Glu Val Phe Ile Asp Leu
260 265 270

Pro Leu Lys Ile Cys Glu Ala Arg Asp Pro Lys Gly Leu Tyr Lys Leu
275 280 285

Ala Arg Thr Gly Lys Ile Lys Gly Phe Thr Gly Ile Asp Asp Pro Tyr
290 295 300

Glu Pro Pro Ile Asn Gly Glu Ile Val Ile Lys Met Lys Asp Glu Glu
305 310 315 320

Cys Pro Ser Pro Lys Ala Met Ala Lys Gln Val Leu Cys Tyr Leu Glu
325 330 335

Glu Asn Gly Tyr Leu Gln Ala
340

<210> 5
<211> 431
<212> DNA
<213> Oryza sativa

<220>
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<222> (48)
<223> n = A, C, G or T

<220>
<221> unsure
<222> (346)
<223> n = A, C, G or T

<220>
<221> unsure
<222> (431)
<223> n = A, C, G or T

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gtgccgaagg cgtccaatat cttctggcat gattgtgcag ttggccaggc tgatcggcag 120
aagctactga agcagaaagg ttgcgttggt tggatcacag gacttagtgg ttcaggtaaa 180
agtaccctgg catgcacatt agatcgagag ctccatacaa gaggggaagct ttcttatggt 240
cttgatggtg ataatttaag acatgggttg aacaaggatc ttggctttaa ggcggaagac 300
cgtgctgaaa atatacgcaa agttgggtgag gtagcaaagc tattcncaga tgcaagccta 360
gtatgcattg caagtttcaa atctccctat aagagagaac gtgagtcctg gcctgcaat 420
attgtcaaat n 431

<210> 6
<211> 118
<212> PRT
<213> Oryza sativa

<220>
<221> UNSURE
<222> (98)
<223> Xaa = ANY AMINO ACID

<400> 6
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Gly Gln Ala Asp Arg Gln Lys Leu Leu Lys Gln Lys Gly Cys Val Val
20 25 30

Trp Ile Thr Gly Leu Ser Gly Ser Gly Lys Ser Thr Leu Ala Cys Thr
35 40 45

Leu Asp Arg Glu Leu His Thr Arg Gly Lys Leu Ser Tyr Val Leu Asp
50 55 60

Gly Asp Asn Leu Arg His Gly Leu Asn Lys Asp Leu Gly Phe Lys Ala
65 70 75 80

Glu Asp Arg Ala Glu Asn Ile Arg Lys Val Gly Glu Val Ala Lys Leu
85 90 95

Phe Xaa Asp Ala Ser Leu Val Cys Ile Ala Ser Phe Lys Ser Pro Tyr
100 105 110

Lys Arg Glu Arg Glu Ser
115

<210> 7
<211> 936
<212> DNA
<213> Glycine max

<400> 7
gcacgagcca ccgcgaaggc tctgcgacag cctgctacg ccggaatctt tcgcaacatc 60
gaatgcgggc cgtcgccggc ggccgagtcg ctagggtttc cgaagctccg cggaatcaac 120
gtcactggat tgcactgcgg ccgcgcgagc ctcgctctcg tcctccgtgc aaaatcaaag 180
ccgattaggg cgaaggagaa cgcaagcgta agtgcttctc tgatcgatga ctggttcaag 240
ccaattacgg cgaaggagga ttctaacgca gaggaccgta catcttcgtt ttctggtaaa 300
aatctcacc agatgtcaaa tggtgggaac tcgacaaaca ttatgtggca tgactgtcca 360
attcagaaac aagatagaca gcagctgctt cagcaacaag gctgtgttat atggctaact 420
ggcctcagcg gatcaggaaa aagcactatt gcatgtgctc tgagtcaaaag ctgcaactcc 480
aaaggaaaaac tgtcttacat ccttgatggt gacaatattc ggcatggtct aaaccaggat 540
cttagtttta gagcagaaga tcgttctgaa aacattagaa ggattggtga ggtggcaaaa 600
ctctttgcag atgctggtgt tatttgcac actagtttaa tatcaccata ccaaaaggat 660
agagatgcat gcagagcact actttcaaaa ggagatttta ttgaggtttt catagatggt 720
ccactacatg tgtgtgaagc tagggacca aaggactct acaagcttgc tcgagctgga 780
aagatcaaag gtttctactgg tatagatgat ccatatgaac caccgtgtag ttgtgagata 840
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tcctacttgg aggagaacgg atacctgcgg gcttga 936

<210> 8
<211> 311
<212> PRT
<213> Glycine max

<400> 8
Ala Arg Ala Thr Ala Lys Ala Leu Arg Gln Pro Cys Tyr Ala Gly Ile
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Phe Arg Asn Ile Glu Cys Gly Pro Ser Pro Ala Ala Glu Ser Leu Gly
20 25 30
Phe Pro Lys Leu Arg Gly Ile Asn Val Thr Gly Leu His Cys Gly Arg
35 40 45
Arg Gly Leu Val Leu Val Leu Arg Ala Lys Ser Lys Pro Ile Arg Ala
50 55 60
Lys Glu Asn Ala Ser Val Ser Ala Ser Leu Ile Asp Asp Trp Phe Lys
65 70 75 80
Pro Ile Thr Ala Lys Glu Asp Ser Asn Ala Glu Asp Arg Thr Ser Ser

85

90

95

Phe Ser Gly Lys Asn Leu Thr Gln Met Ser Asn Val Gly Asn Ser Thr
 100 105 110
 Asn Ile Met Trp His Asp Cys Pro Ile Gln Lys Gln Asp Arg Gln Gln
 115 120 125
 Leu Leu Gln Gln Gln Gly Cys Val Ile Trp Leu Thr Gly Leu Ser Gly
 130 135 140
 Ser Gly Lys Ser Thr Ile Ala Cys Ala Leu Ser Gln Ser Leu His Ser
 145 150 155 160
 Lys Gly Lys Leu Ser Tyr Ile Leu Asp Gly Asp Asn Ile Arg His Gly
 165 170 175
 Leu Asn Gln Asp Leu Ser Phe Arg Ala Glu Asp Arg Ser Glu Asn Ile
 180 185 190
 Arg Arg Ile Gly Glu Val Ala Lys Leu Phe Ala Asp Ala Gly Val Ile
 195 200 205
 Cys Ile Thr Ser Leu Ile Ser Pro Tyr Gln Lys Asp Arg Asp Ala Cys
 210 215 220
 Arg Ala Leu Leu Ser Lys Gly Asp Phe Ile Glu Val Phe Ile Asp Val
 225 230 235 240
 Pro Leu His Val Cys Glu Ala Arg Asp Pro Lys Gly Leu Tyr Lys Leu
 245 250 255
 Ala Arg Ala Gly Lys Ile Lys Gly Phe Thr Gly Ile Asp Asp Pro Tyr
 260 265 270
 Glu Pro Pro Cys Ser Cys Glu Ile Val Leu Gln Gln Lys Gly Ser Asp
 275 280 285
 Cys Lys Ser Pro Ser Asp Met Ala Glu Glu Val Ile Ser Tyr Leu Glu
 290 295 300
 Glu Asn Gly Tyr Leu Arg Ala
 305 310

<210> 9

<211> 928

<212> DNA

<213> Triticum aestivum

<400> 9

gcacgagggc ggacgcaggg gagaggatgg cgggggtcaga agccgtgccg gtgggtggctg 60
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 cctcaactgt tgggaaatcg acaaacgttc tttggcatga ctgtccaata ggtcagtttg 180
 agaggcagga actgctaaat cagaagggtt gtgttgtgtg gataacaggg ttaagtgggt 240
 cagggaaaag cacactagca tgcgcgctaa gtcgcgagct gcactccaga ggtcatctga 300
 cctacattct agacggtgac aatctaaggc atgggttaaa ccgagacctc tgtttcgaag 360
 caaaggaccg tgctgaaaaat atacgcagag taggagaagt agcaaaagctg tttgcagatg 420
 ctggtctgat ctgcattgct agcttgatat caccctacag aagtgaacgc agcgttgcc 480
 gcaaattact gcacaattct acattcatcg aggtgttttt gaatgtccca cttgaagttt 540
 gtgaagctag ggatccaaaa ggcttgtaca agcttgcccg tgcaggaaaa atcaaagggt 600

ttactggaat tgatgatcct tatgaagcac cttctgactg cgagatagtg atacagtgca 660
aagctgggtga ctgcgccacg cctaaatcga tggctgatca agttgtgtca tatcttgaag 720
caaatgagtt cttacaggaa tagagacgta tgctatggat gaaaaaacat tctgaaattg 780
gatcgccaag ggaatgtgaaa tatgaggtag tatttatgtc tagaaagagt gatgatagta 840
tgagaacata tatattgaca taaagatcga atctgtacat cattataata aattgaaatg 900
ttttgacgca aaaaaaaaaa aaaaaaaaaa 928

<210> 10
<211> 246
<212> PRT
<213> Triticum aestivum

<400> 10
Thr Arg Ala Asp Ala Gly Glu Arg Met Ala Gly Ser Glu Ala Val Pro
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Val Val Ala Val Ala Ala Gly Lys Gln Pro Val Asn Gly Ser Ala Met
20 25 30
Ala Gly Ile Asp Lys Leu Val Thr Ser Thr Val Gly Lys Ser Thr Asn
35 40 45
Val Leu Trp His Asp Cys Pro Ile Gly Gln Phe Glu Arg Gln Glu Leu
50 55 60
Leu Asn Gln Lys Gly Cys Val Val Trp Ile Thr Gly Leu Ser Gly Ser
65 70 75 80
Gly Lys Ser Thr Leu Ala Cys Ala Leu Ser Arg Glu Leu His Ser Arg
85 90 95
Gly His Leu Thr Tyr Ile Leu Asp Gly Asp Asn Leu Arg His Gly Leu
100 105 110
Asn Arg Asp Leu Cys Phe Glu Ala Lys Asp Arg Ala Glu Asn Ile Arg
115 120 125
Arg Val Gly Glu Val Ala Lys Leu Phe Ala Asp Ala Gly Leu Ile Cys
130 135 140
Ile Ala Ser Leu Ile Ser Pro Tyr Arg Ser Glu Arg Ser Ala Cys Arg
145 150 155 160
Lys Leu Leu His Asn Ser Thr Phe Ile Glu Val Phe Leu Asn Val Pro
165 170 175
Leu Glu Val Cys Glu Ala Arg Asp Pro Lys Gly Leu Tyr Lys Leu Ala
180 185 190
Arg Ala Gly Lys Ile Lys Gly Phe Thr Gly Ile Asp Asp Pro Tyr Glu
195 200 205
Ala Pro Ser Asp Cys Glu Ile Val Ile Gln Cys Lys Ala Gly Asp Cys
210 215 220
Ala Thr Pro Lys Ser Met Ala Asp Gln Val Val Ser Tyr Leu Glu Ala
225 230 235 240
Asn Glu Phe Leu Gln Glu
245

<210> 11
 <211> 521
 <212> DNA
 <213> Triticum aestivum

<400> 11
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 aggcaatggc ccagcaagtt ctgtcctacc ttgagaagaa cggatatttg caggcttagc 180
 atatatatac tccagatcca gaagattgaa cttattcttc tgtgtccata actcatggac 240
 acaggcatga tccatttggg cgcacccgga ataaaaggcg ctgttattga agcaacaagc 300
 tgcctttttc acggggaaaag ggacgcagat cgatgatcag ttgtattgtt cggcattgct 360
 cctctcgcg cgtgtgtgct atttttagctg tagtctatac ttgctcattt cggctgaaat 420
 ggtgtgctgt gctgtgctgt gtttatttgt tggtaatgta tgatttgatt gtgggtgtca 480
 aaagtacgaa tgaataaatc gtgcttgctg tttcaaaaaa a 521

<210> 12
 <211> 58
 <212> PRT
 <213> Triticum aestivum

<400> 12
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 20 25 30
 Gly Gly Glu Cys Pro Ser Pro Lys Ala Met Ala Gln Gln Val Leu Ser
 35 40 45
 Tyr Leu Glu Lys Asn Gly Tyr Leu Gln Ala
 50 55

<210> 13
 <211> 312
 <212> PRT
 <213> Catharanthus roseus

<400> 13
 Met Ile Gly Ser Val Lys Arg Pro Val Val Ser Cys Val Leu Pro Glu
 1 5 10 15
 Phe Asp Phe Thr Glu Ser Thr Gly Leu Gly Lys Lys Ser Ser Ser Val
 20 25 30
 Lys Leu Pro Val Asn Phe Gly Ala Phe Gly Ser Gly Gly Gly Glu Val
 35 40 45
 Lys Leu Gly Phe Leu Ala Pro Ile Lys Ala Thr Glu Gly Ser Lys Thr
 50 55 60
 Ser Ser Phe Gln Val Asn Gly Lys Val Asp Asn Phe Arg His Leu Gln
 65 70 75 80
 Pro Ser Asp Cys Asn Ser Asn Ser Asp Ser Ser Leu Asn Asn Cys Asn
 85 90 95
 Gly Phe Pro Gly Lys Lys Ile Leu Gln Thr Thr Thr Val Gly Asn Ser

65		70		75		80									
Ile	Lys	Trp	His	Glu	Cys	Ser	Val	Glu	Lys	Val	Asp	Arg	Gln	Arg	Leu
			85						90					95	
Leu	Asp	Gln	Lys	Gly	Cys	Val	Ile	Trp	Val	Thr	Gly	Leu	Ser	Gly	Ser
		100						105					110		
Gly	Lys	Ser	Thr	Leu	Ala	Cys	Ala	Leu	Asn	Gln	Met	Leu	Tyr	Gln	Lys
		115					120					125			
Gly	Lys	Leu	Cys	Tyr	Ile	Leu	Asp	Gly	Asp	Asn	Val	Arg	His	Gly	Leu
	130					135					140				
Asn	Arg	Asp	Leu	Ser	Phe	Lys	Ala	Glu	Asp	Arg	Ala	Glu	Asn	Ile	Arg
145					150					155					160
Arg	Val	Gly	Glu	Val	Ala	Lys	Leu	Phe	Ala	Asp	Ala	Gly	Ile	Ile	Cys
				165					170					175	
Ile	Ala	Ser	Leu	Ile	Ser	Pro	Tyr	Arg	Thr	Asp	Arg	Asp	Ala	Cys	Arg
			180					185						190	
Ser	Leu	Leu	Pro	Glu	Gly	Asp	Phe	Val	Glu	Val	Phe	Met	Asp	Val	Pro
		195					200					205			
Leu	Ser	Val	Cys	Glu	Ala	Arg	Asp	Pro	Lys	Gly	Leu	Tyr	Lys	Leu	Ala
		210				215					220				
Arg	Ala	Gly	Lys	Ile	Lys	Gly	Phe	Thr	Gly	Ile	Asp	Asp	Pro	Tyr	Glu
225					230					235					240
Pro	Pro	Leu	Asn	Cys	Glu	Ile	Ser	Leu	Gly	Arg	Glu	Gly	Gly	Thr	Ser
				245					250					255	
Pro	Ile	Glu	Met	Ala	Glu	Lys	Val	Val	Gly	Tyr	Leu	Asp	Asn	Lys	Gly
			260					265					270		
Tyr	Leu	Gln	Ala												
			275												